5.8 SOFTWARE QUALITY ASSURANCE AND VALIDATION.

5.8.1 Software Requirement. Only verified, validated, documented, and configuration controlled software shall be used for performing calculations supporting nuclear criticality safety analyses. The software used for calculations shall be the same version used in validating the software for determining areas of applicability and subcritical acceptance criteria or upper subcritical limits. The dated, unambiguous, and unique identification of the software shall be stated. As temporary as the use may be, programmable calculator use and personal computer programs also shall be thoroughly tested, verified, validated, and documented for application to the problem being calculated when the results of such applications are incorporated in CSEs.

5.8.2 Verification of Calculational Method. For software program development, the verification process shall be applied throughout the activities involving problem and software definition, software design, coding, integration and testing, installation and continued operation, and maintenance. For independently developed, tested, verified, and packaged software that is migrated or ported to an intended user computer/calculator platform, verification of integration and testing and continued operation and maintenance shall be performed. The verification process shall conform to the guidance provided in the applicable document sections 2.1.17, 2.2.2.7, 2.3.1.14, and 2.3.1.15.

5.8.3 Software Configuration Control. APPENDIX E provides an acceptable approach for software configuration control that addresses the requirements of government and industrial standards described in the reference of section 2.2.2.7.

5.8.4 Validation of Calculational Method. The justification for the validity of the selected computational method shall be documented and should include

(a) the selection and description of the critical experiments used in the validation, or an appropriate reference that describes the experiments in adequate detail to permit reconstruction of computational input,

(b) the selection and description of the computational method that is to be validated along with any necessary data for performing calculations or comparisons (e.g., neutron cross sections, material bucklings, limiting surface densities, or other similar data),

(c) the selection and description of the computer/calculator platform and associated operating system used in the validation,

(d) the nuclear properties, such as cross sections, which should be consistent with experimental measurements of these properties,

(e) a description of similarities and differences between the critical experiments and the calculational models used for the validation,

(f) all geometric, material, and nuclear physics related input variables used for the validation of the calculational or comparative method, with sketches provided,

(g) the basis for the calculational or comparative bias and the determination of an acceptance criterion for calculated subcritical results, and

(h) the areas of applicability of the calculational or comparative bias and the acceptance criterion, and upper subcritical limit, developed from the validation effort.

Example approaches for performing a computational technique validation are provided in APPENDIX F.

5.8.5 Code user corroboration. Code users shall perform at least some of the validation and cross-check calculations to demonstrate their ability to use the codes properly. Also code users should compare results between codes, experimental data, and hand calculational methods insofar as practical to provide sanity checks on results. Lastly, as a separate effort, code users should participate in blind round robins periodically to demonstrate continued competence with the methods and data used in evaluations.